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Changing Aptitude Achievement and Relationships in Instruction: A Comment

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for

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Findings of variable relationships between cognitive aptitudes and instructional outcomes were seen as a challenge to the aptitude treatment interaction paradigm. This paper points out that correlations between preceding and succeeding modules were generally as high as those between module outcomes and the 24 cognitive aptitudes. These data lend further support to the variability of the achievement treatment interaction formulation.

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Changing Aptitude--Achievement Relationships in Instruction: A Comment

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A recent study by Federico (1983) demonstrated that there was considerable variablility in the relationships between different aptitudes and instructional outcomes. Federico suggested that such a lack of consistency raised questions regarding the usefulness of aptitude treatment interaction (ATI) research for instructional design. The purpose of this comment is to suggest some alternate interpretations of Frederico's data indicating that the implications of these results for ATI research are more encouraging than was first apparent.

Federico administered 24 individual difference measures to 166 Navy trainees who completed a hierarchically organized, mastery based, computer managed instruction course consisting of 11 modules. The course required a mean Of 101.7 hours of student time. The test scores were submitted to factor analysis and varimax rotation yielding seven orthogonal factors. Factor scores were then computed and correlated with subject's achievement on the modules. The pattern of correlations between factors and achievement on the modules shifted substantially,

from one module to another. Furthermore, the multiple correlation between scores on all factors and achievement was relatively modest, ranging from a high of .47 to a low of .23. These results were substantially similar to those reported by Burns (1980) using a brief instructinal sequence dealing with an imaginary science.

Both Burns and Federico pointed out that their results were troublesome for the ATI paradigm which, of course, assumes that there is no one optimal instructional method for all individuals. Instead, it is hypothesized (Cronbach and Snow, 1977) that one method may be superior for students at one end of an individual difference continuum, whereas another may be optimal for students at a different point on the continuum. Variability in aptitude-outcome correlations, of course, indicates that the psychological processes required for mastery shift from one module to the next. The difficulties of such variability for ATI research were described by Tobias (1976) as follows.

> "If the psychological processes demanded shift from what they were at task outset, the instructional strategies designed to teach that task similarly have to shift. In terms of ATI, then, method X, which is supposed to depend on ability x , and method Y which depends on ability y may both shift with respect to the abilities involved since these may have changed from those demanded earlier by the task. . . . . Does it then make sense to develop several instructional methods when the degree to which they require different abilities is likely to change once the student has found his way into the task?" (p. 65).

In Federico's study the correlations between achievement of adjacent modules were also reproduced (Table 1, p. 160-161) These ranged from a low of .19 to a high of .48. In general, these zero order correlations between posttest scores on adjacent modules were approximately as high as the multiple correlations between the factor scores and achievement on the module. Table 1, adapted from Tables and 4 in Federico's paper reproduces the essential data.

INSERT TABLE 1 ABOUT HERE

Table 1 indicates that a single prior achievement measure, the posttest on the preceding module, predicted instructional outcome approximately as well as 24 individual difference measures used by Federico. Such results were anticipated (Tobias, 1976) is recommending that adapting instruction to individual differences in prior achievement, may lead to more stable results than the use of aptitudes. We are <u>not</u> suggesting that the posttest contains different information than that represented by the seven crystalized and fluid aptitude factors in Federico's data. Instead, the likelihood that the factor information may well be summarized in the posttest score makes the latter more convenient and stable for use in adaptive instruction. These results and those reported by Burns (1980) provide striking support for the viability of the achievement treatment formulation, compared to an aptitude-treatment approach.

Tobias (1976) predicted an inverse relationship between prior

Table 1. Multiple Correlations Between Factor Scores and Module Achievement Test Results, and Correlations of Preceding with Succeeding Module Results.

	Module Scores										
Correlations	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5	Mod 6	Mod 7	Mod 8	Mod 9	Mod 10	Mod 11
R	.34**	.45**	.23	.31**	.36**	.35**	.34**	.37**	.34**	.43**	.47**
r	-----	.41	.19	.19	.31	.48	.36	.24	.50	.35	.38

achievement and amount of instructional support required. "Instructional support was defined as the assistance given the learner by way of organizing the instructional content, maintaining studen attention, eliciting responses, providing feedback on the responses and so on" (Tobias, 1982, p.5). It was suggested that students high in prior achievement may be assigned to a "lean" instructional strategy, whereas those low in prior achievement might require an augmented strategy providing various forms of assistance. The achievement-treatment formulation was revised (Tobias, 1982) to suggest that only those forms of instructional support which improved students macroprocessing, or the frequency and intensity of cognitive processing of instructional input, would improve achievement. If instrucional support reduced student macroprocessing, no achievement increments would be expected.

It should be noted that the correlations between preceeding and succeeding modules in Federico's data do not have a motonic relationship. In a hierarchically organized course one would assume that adjacent modules should correlate most substantially, while the correlations of modules further removed from one another should decrease. This was not the case with the modules used in Federico's study. These results may suggest that these modules were not as hierarchically organized as had been assumed, and that, even though the course dealt with electricity, content differences from one module to the next were more substantial than first believed. These content differences may also help to explain the relatively modest correlation among different modules.

If the achievement treatment hypothesis were to be applied to adapt instruction to student differences, it might be advisable to

include some pretest items on succeeding modules in the outcom measures of prior learning. Such tests would be more useful in predicting which instructional method would lead to optima achievement on succeeeding modules, since posttests measure only what the student has mastered previously. Including some items drawn fro the next module on posttests would improve the relationship with outcomes since content not included in the preceding module could the be sampled. Such a practice would, probably, substantially increas the correlations between prior outcomes and succeeding achievement making the achievement treatment formulation even more useful in practical situations.

The results reported both by Federico (1983) and by Burns (1980) provide clearcut support for the achievement treatment hypothesis. The stability of prior achievement-outcome correlations, compared to the relationships with aptitudes, attest to the usefulness of the achievement treatment formulation heuristically as well as making this approach useful for instructional design.

Footnote

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